Effectiveness of Utilizing Enhanced Geonopoly as a Review Material on the Achievement and Engagement Levels of Grade 7 Learners in Geometry

Eric T. Lascoña
Mindanao State University – Iligan Institute of Technology,
Andres Bonifaco Ave., Tibanga, Iligan City
eric.lascoña@g.msuiit.edu.ph

Douglas A. Salazar
Mindanao State University – Iligan Institute of Technology,
Andres Bonifaco Ave., Tibanga, Iligan City
douglas.salazar@g.msuiit.edu.ph

Abstract
This study focused on the effectiveness of an enhanced Geonopoly as a review material on the learners' achievement and engagement levels toward Geometry. Geonopoly came from two combined words "Geo" (Geometry) and "nopoly" (Mathonopoly) based on an existing game called Mathonopoly. With the use of quasi-experimental design, 40 learners from Acelo C. Badelles Sr. Memorial High School were the subjects of the study. To find out the game's effectiveness, the learners were grouped into four groups with 5 members. Three groups were utilized as experimental treated with Geonopoly with the remaining learners were the control group. To ensure the learners' comparability, mean grades on each group from the previous two grading periods were used as important data. Rubric, Achievement Test, and Engagement level questionnaires were used as research instruments. The significant result of ANOVA showed that Geonopoly made a significant difference in the mean scores shown in the Achievement and Engagement Levels between two groups. Utilizing Bonferroni comparison test, it was found out that only learners from Group 2 under experimental group have significantly higher achievement level when compared to the control group. Moreover, insights drawn from the learners were grouped into three themes. Learners were mostly happy with the game, some learners also said they enjoyed it and some said they learned. With these gathered results, learners' responses showed that the board game Geonopoly made a significant impact on their behavioral, emotional, and cognitive.Therefore, enhanced Geonopoly is an effective way to improve the achievement and engagement levels of the Grade 7 learners towards Geometry.
Keywords: effectiveness, engagement, Geonopoly

1. Introduction
In today's generation learners are becoming active. What takes place inside the classroom involves educators as the facilitator of learning, and learners as the producers of knowledge. When teachers provide a classroom environment that fosters active engagement, learners develop critical thinking skills. Hence, learning takes place (Amushigamo, 2021). Practicing this pedagogy, learners learn to have positive perceptions of the learning process. They begin to improve self- efficacy, independence, and their motivation to learn increases. One of the core subjects that must be taught in a learner-centered approach is math.

Since Mathematics is everywhere, it is considered the building block in our daily lives. With this fact, there should be greater emphasis on teaching the subject. In the recent data shown by TIMMS, Filipino learners ranked lowest in Mathematics and Science among 58 participating countries. The country scored significantly lower with 297 in mathematics and 247 in science respectively (Inquirer.Net). One possible implication for this is that Filipino learners do not like to learn Math. If learners do not understand the real- life application of the subject, it could be that they have been deprived of opportunities to be exposed to appropriate and meaningful Mathematics education that gives them a feeling of understanding and enjoyment (Barbosa and Vale, 2016). Even when learners can understand mathematics, if they are incapable of establishing connections between the concepts and their application, learning is still at stake.

Geometry is one of the branches in Math perceived to be difficult by the learners (Fabiyi, 2017, Tatlah et al, 2017). Since this subject requires learners to utilize higher-order thinking skills, it is highly recommended that the recognized difficult geometry concepts in geometry should be taught by using appropriate teachers' methods and instructional materials. On the contrary, Yilmazer, Z. et. al. (2015) argued that traditional teaching methods have no significant effects on learners' success in learning geometry. . Brannan, J. D et.al (2016) explained that

faculty should explore new methods of teaching that consider how learners learn. In response to this, there is a need to provide excellent models for designing the next generation of learning assessments. Kirkland and Fiona O'Riordan (2010) showed that in- class games do have a positive impact on the learners. In utilizing gamification, studies found out that it offers learning opportunities (Majdoub,2022). Experimental studies on gamified learning showed positive improvement not only in the learners' motivation and engagement, but also in their learning achievement (Zainuddin, Chu, Shujahat & Perera, 2020).0

In the unpublished study of Lascoña, Muti, and Taganos (2019) entitled "Geonopoly as a Formative Assessment: Effects on Grade 7 Learners' Achievement Level and Attitude towards Geometry", the same results of Erica M. McAndrew et al, (2017) showed that the use of board games as a formative assessment was helpful in increasing the achievement level of the learners from experimental group compared to the control group. Using the Mann-Whitney U test, there was a significant difference in the learners' scores mean ranks. Therefore, with the findings and recommendations of the study above, the present researcher made enhancement of Geonopoly in terms of appearance, rules, mechanics, and purpose. This research is set to innovate a marketable board game that teachers can utilize in the classrooms. In general, the main objective centers the effectiveness of board games as review material for learners' achievement and engagement levels.

2. Methods

2.1 Research Design

This study employed a mixed method approach and was conducted within the context of embedded design. A mixed method approach to research is when a researcher gathers, analyzes, integrates, and draws inferences from data using both qualitative and quantitative approaches and methods in a single study or a series of studies to better understand a research problem (Creswell & Plano Clark, 2011; Tashakkori & Creswell, 2007. The data were collected using a quasi-experimental approach, while the qualitative data were collected using a learner's math notebook and an interview. The difference in achievement levels between learners who play Geonopoly (a geometry-based board game) and those who do not was shown by the post-test achievement test that was administered to both groups.

2.2 Research Setting

The study was conducted at Acelo C. Badelles Sr. Memorial High School formerly Tipanoy National High School located at Purok 6, Tipanoy, Iligan City, Philippines. It is a government-owned school of the Department of Education that offers education for junior and senior high school students.

2.3 Participants of the Study

Two sections with a total of 40 Grade 7 learners from Acelo C. Badelles Sr. Memorial High School participated in the research. The learners were divided into four groups, each with a similar background and set of characteristics in relation to age, educational background, and comparable grades. The experimental group consisted of three groups, while one group for the control group respectively. The researcher determined the respondents from the decision given by the School Principal. Since the school is under a limited progressive face-to-face, learners were scheduled into morning and afternoon sessions. 20 learners in the first section while the other 20 in the afternoon session. Utilizing lottery sampling technique, learners were grouped randomly.

2.4 Research Instruments

The following instruments were utilized by the researcher in accomplishing the study.

2.4.1 Achievement Test

The achievement test measures what the learners learn from the whole quarter. It is a 40-item achievement test prepared by the researcher, parallel to the centralized assessment given to learners from the division of Iligan City. A table of specification (TOS) was utilized and the items were analyzed.

A dry run approved by the School Principal was conducted at Iligan Capitol College, a private institution which offers online learning modality. The result of the achievement test showed that 8 items must be revised (Items 5, 10, 12, 14, 15, 32, 39, 40) and the rest of the items were retained.

2.4.2 Engagement Level Questionnaire

An adapted Engagement Level questionnaire from a published study of Barana et. Al (2020) was utilized to acquire learners' interest in learning Geometry while being exposed to the board game. The questionnaire was measured in its internal consistency with reliability test using Cronbach's Alpha. The dry run of this instrument calculated a Cronbach value of 0.866480 and its internal consistency was interpreted as good.

2.4.3 Learners' Math Journal with Interview

To secure qualitative data, the research required learners to a math journal where they can write the whole duration of the study. This instrument was evaluated by the in-service teachers from Acelo C. Badelles Sr. Memorial High School. The instrument was used so that learners can narrate how Geonopoly helped them in

terms of their achievement and engagement levels.

2.4.4 Intervention

Geonopoly is a geometry-based board game that was enhanced from an unpublished work by Lascoña, Taganos, and Muti (2019) which was based on Manoj Mistry's great Mathonopoly proposal. This serves as pre-assessment review material for the experimental learners. During the treatment time, the experimental group of learners were exposed to Geonopoly. The questions found in Geonopoly cards were mapped to the Most Essential Learning Competencies (MELCS) of Grade 7 Mathematics.

2.5 Data Gathering Procedure

The following procedure was undertaken by the researcher to conduct the study.

2.5.1 Preliminary Procedures

The data gathering procedure technically commenced by April 29, 2022 It started with a letter of request addressed to the Schools Division Superintendent), letter of approval to conduct face-to-face data gathering from the office of IATF and another separate letter addressed to the School Principal of Acelo C. Badelles Sr. Memorial High School. After approval, the researcher was assigned to an in- service teacher in accordance with the prospect Grade level. Due to the current situation, the researcher purposely selected Grade 7 learners from Acelo C. Badelles Sr. Memorial High School. The researcher used quasi-experimental approach; two groups were utilized. One for the experimental with three groups of learner and with 10 members each respectively. The selection of these learners was approved from an Informed consent form, Assent form, and Parent consent letter that they allowed learners to be part of this endeavor. A toss of a coin was utilized to determine the group of learners. The learners in the experimental group were determined using a lottery method of sampling.

2.5.2 Game Proper

Since the school is under limited progressive face-to-face, learners were scheduled into morning and afternoon sessions. There were 20 learners in the morning session and the other half were in the afternoon. In conducting the game, an orientation was done first. After which, experimental group 1 and 2 were split into two. Four board games were utilized and learners were playing for the entire 60-minute period. 4 groups played simultaneously ensuring that they were wearing facemasks at all times. 4 learners served as players while the other one acted as the scorer. The scorer has the access to the key answer of each question. The duration of the game was given 45 minutes and the remaining 15 minutes was for them to fix the board game. The same procedure happened for the last experimental group in the afternoon. The researcher conducted the review for the control group while the third group of the experimental group was treated with Geonopoly.

2.6 Data Analysis

Table 1

Achievement Test Score Summary

Achievement Test Score	Percentage	Achievement Level Interpretation
36-40	90% and above	Advance
34-35	85%-89%	(P) Proficient
32-33	80%-84%	(AP) Approaching Proficient
30-31	75%-79%	(D) Developing
Below 29	74% and below	(B) Beginning

Note: *From https://www.ciit.edu.ph/k-to-12-grading-system/*

Both quantitative and qualitative analyses were done to determine the effectiveness of an enhanced Geonopoly on the achievement and engagement levels of the learners. The quantitative data were derived from the achievement test and the Engagement level questionnaire while the qualitative data were derived from the learners' Math journals and with follow-up interview results. Table 1 was used on the study to interpret the achievement level of experimental and control groups based on their achievement test scores.

Table 2

Engagement Level Scoring

MEAN INTERVAL	INTERPRETATION
1.00 - 2.33	Strongly Engaged
2.34 - 3.67	Somewhat Engaged
3.68 - 5.00	Poorly Engaged

*Note:*From   *https://www.researchgate.net/publication/309240449_Four_Common_Misuses_of the_Likert_Scale*

Meanwhile, Table 2 was used for scoring and interpretation of engagement level by the participants of the study. It was used to quantify the learners' engagement after being treated with the game Geonopoly.

2.7 Statistical Tools

The researcher utilized the following statistical tools to interpret and analyze the data.

    a. Mean and Standard Deviation

This was used to calculate the average academic level of the learners' achievement test and rubric; and, to determine the distribution of scores of the respondents in the activity perception questionnaire, achievement test.

    b. Cronbach's Alpha Test of Reliability

To ensure a reliable multiple-question Likert scale survey, the researcher used this test to calculate if the Engagement Level Questionnaire accurately measures the variable of the interest.

    c. Analysis of Variance (ANOVA)

This is a statistical formula used to compare variances across the means (or average) of different groups. A range of scenarios uses it to determine if there is any difference between the means of different groups.

    d. Post Hoc Analysis: Bonferroni Comparison Test

The Bonferroni test is a type of multiple comparison test used in statistical analysis. The researcher utilized this test to show which of the result could appear to demonstrate statistical significance in the dependent variable, even when there is none.

2.8 Coding of Data

The researcher analyzed and interpreted all qualitative data collected from experimental group's interview. For the learners, codes were employed in the presentation of these data. The codes represented the student identification number and the group. EG1 corresponded to "experimental group learner 1".

3. Results and Discussions

Objective 1: 1.Determine the learners' achievement level in Geometry.

Table 3

Learner's Achievement Level in Geometry (n=40)

GROUP	MEAN	STD. DEV.	INTERPRETATION
Experimental Group1	30.4	3.03	Developing
Experimental Group2	31.7 (~32)	4.27	Approaching Proficient
Experimental Group 3	30.2	4.47	Developing
Control Group 4	26.5(~27)	4.49	Beginning
Over-all Mean	30.075	4.17	Developing

    Table 3 presents the learner's achievement level in Geometry for both control and experimental groups. Comparing the mean scores between the two groups, learners treated with Geonopoly have significantly achieved better than the learners from control group (30.4, 31.7, 30.2, 26.5 > 26.5) Generally speaking, the calculated mean scores in each group was found to have a favorable impact on learners' success in higher achievement through the utilized Geonopoly.

    With this data, it showed that the enhanced Geonopoly is an effective review material for enhancing the achievement level of Grade 7 learners in Geometry. The researcher concluded that when learners are provided a classroom environment that fosters active engagement, and develops critical thinking skills, achievement level improves (Amushigamo, 2021). The use of Geonopoly resulted in a greater achievement score. Hence, game-based learning develops the learners' academic aptitude and cognitive competencies. Thus, it increases their academic (Türkoglu, 2019) and it is clear to say that Geonopoly offers learning opportunities to the learners. (Majdoub,2022).

Objective 2: Identify the learners' engagement level toward Geometry.

Table 4

Learners' Engagement Level toward Geometry (n=40)

GROUP	MEAN	STD. DEV.	INTERPRETATION
Experimental Group1	4.21	0.09	Strongly Engaged
Experimental Group2	4.24	0.11	Strongly Engaged
Experimental Group 3	4.30	0.10	Strongly Engaged
Control Group 4	3.24	0.11	Somewhat Engaged
OVER-ALL MEAN	4.00	0.46	POSITIVE ENGAGEMENT

    Table 4 presents learners' engagement level toward Geometry. As observed, the calculated mean of 3.24 and standard deviation of 0.11 from the control group was found to have lower engagement compared to the experimental groups with 4.21, 4.24 and 4.30 calculated means respectively.

This shows that learners under the experimental group have a higher engagement level compared to those on the control group. In the study of Bragg, L. A. (2012), the same result was contended that use of games explicitly addressing the mathematical content being taught in a classroom is one way to increase engagement and, in turn, potential for learning.

With clear evidence, the treatment method in utilizing enhanced Geonopoly is found to be effective asa review material in improving the engagement level of the Grade 7 learners towards Geometry.

Objective 3: Compare the mean score difference in the achievement level between experimental and control groups.

Table 5

ANOVA Table on the Mean Score Difference in Learner's Achievement Level

SOURCE	SS	DF	MS	F	SIG. (P- VALUE)
Between Groups	149.8	3	49.93	3.23	0.0336*
Within Groups	556.6	36	15.46		
Total	706.4	39	18.11		

Table 5 presents the result of one-way analysis of variance (ANOVA) in testing the significant mean score difference of learner's achievement level among one control group and three experimental groups. At 0.05 level of significance, the calculated p-value of 0.0336 (<0.05) reveals that there is sufficient evidence to conclude that the mean score of the learner's achievement level is statistically different among one control and three experimental groups.

The achievement level of the learners is higher for the experimental group compared to the control group. This finding backup the study of Okechukwu et.al that when learners taught using mathematical games, they performed significantly better than learners taught using the traditional method. Through utilizing Geonopoly, learners in the experimental group obtained higher achievement level as they applied their own understanding of the game's rules.

Table 6

Post Hoc Analysis: Bonferroni Comparison Test

GROUPS	MEAN	MEAN DIF. (CONTROL-TRIAL)	SIG.
Experimental Group1	30.4	-3.9	0.1980
Experimental Group2	31.7	-5.2	0.0330*
Experimental Group 3	30.2	-3.7	0.2550
Control Group 4	26.5		

After the confirmation of a significant result of ANOVA, the Bonferroni comparison test is used to see which groups between control and experimental groups vary statistically. As revealed by the Bonferroni comparison test, only learners of trial 2 under experimental group have significantly higher achievement level when compared to the control group.

Therefore, enhanced Geonopoly is an effective way to improve the achievement level of the Grade 7 learners towards geometry. This agrees with the result presented in Table 3

Objective 4: Compare the mean score difference in the Engagement Level between experimental and control groups.

Table 7

ANOVA Table on the Mean Score Difference in Learner's Engagement Level

SOURCE	SS	DF	MS	F	SIG. (P-VALUE)
Between Groups	7.75	3	2.58	242.61	0.0001*
Within Groups	0.38	36	0.01		
TOTAL	**8.13**	**39**	**0.21**		

Table 6 presents the result of one-way analysis of variance (ANOVA) in testing the significant mean score difference of learner's engagement level among one control group and three experimental groups. As observed, the null hypothesis is rejected at the given 5% alpha level (0.0001 <0.05). This result suggested that learners in the experimental group of this study improved their understanding as they used their knowledge of the game's rules to solving Geometry problems (Okechukwu et.al, 2014).

Therefore, there is enough data to believe that the mean score of engagement level for both control and experimental groups varies significantly. Similarly, enhanced Geonopoly is also effective in enhancing the engagement level of the Grade 7 learners towards geometry. This confirmed the result presented in Table 4.

Table 8

GROUPS	MEAN	MEAN DIF. (CONTROL-TRIAL)	SIG.
Experimental Group1	4.21	-0.978	0.0001*
Experimental Group2	4.24	-1.002	0.0001*
Experimental Group 3	4.30	-1.062	0.0001*
Control Group 4	3.24		

Post Hoc Analysis: Bonferroni Comparison Test
*Significant at 5% α level (if p<0.05)

The result of the calculated Bonferroni comparison test shows that all groups under the experiment have significantly different engagement levels compared to control groups. It follows that the experimental groups have higher engagement levels the than control group.

This finding shows that Geonopoly as an alternative assessment to Grade 7 learners found to be effective in improving their engagement towards Geometry. This finding agreed to Heinzen (2014) noted that in order to capture peak performance of the learners, Game-based assessment (GBA) must foster engagement. Moreover, DiCerbo (2015), added that learners can be assessed without the use of paper and pencil tests as boardgames provide engaging environment as evidence for what learners can do and know. about a learner's progress.

Objective 5: Draw insights from the learners' Math journal with an Interview.

With the responses gathered, most of the experimental learners have positive response to the game. Some learners said, "I enjoyed the game that I played with my friends and I also realized that Geometry is a nice subject while playing with friends." (EG4, EG5, EG14, EG16, EG28, EG29); "I enjoyed the game because my classmates solved the problems well and I just knew that Geometry can be learned out of play." (EG3, EG11, EG17, EG18, EG20, EG21, EG22, EG24, EG25, EG27). Some learnersrecommend the board game to their classmates "I will let my classmates play Geonopoly so they can learn like me. Thank you, Sir!" (EG8, EG9, EG15, EG19). Some learners found the questions on Geonopoly hard. "I learned from the game despite that some questions were hard."(EG1, EG6, EG12). Learners were also happy playing the game, "I suddenly forget my problems. It made me totally happy" (EG2, EG7, EG10, EG13, EG23, EG,30)

Learners' insights drawn can be categorized into three. 47% learners learned with Geonopoly, 30% were happy, and 23% learners said they enjoyed it. Samples from the taken responses is found on Appendix AF. With these gathered results, using thematic analysis, learners' responses showed that the board game Geonopoly made a significant impact on their Behavioral, Emotional, and Cognitive Fredericks, et. al (2004) as cited in Lester (2013) engagements. Game-based learning sustains interest and attention; improves confidence, learning motivation and performance; increases engagement and achievement; provides opportunities to prepare the future learning, teaches new knowledge and skills, practices and reinforces existing knowledge and skills and develops 21st-century skills (Türkoglu, B. (2019).

4. Conclusions

Based on the above findings, the following conclusions were drawn.

1. Comparing the mean scores on the achievement level by the respondents, learners exposed to the treatment method showed a greater result. Geonopoly has significantly improved the achievement level of learner
2. Learners in the experimental group are found more engaged in learning Geometry compared to learners in the control group. Achievement mean scores are found statistically different. Experimental groups of learners had higher achievement levels. There is sufficient evidence that Geonopoly was found to have significant differences in improving engagement level of learners.

5. Recommendations

Based on the results and conclusion of the study, the following points are highly recommended:

1. In-service Mathematics teachers may utilize Geonopoly to be used in a face-to-face learning environment with consideration of learners' needs and interests.
2. Geonopoly board games may be used as a review material rather than the traditional paper and pen.
3. In-service teachers should make a copy of this game ensuring that the credits to the current and previous researchers are taken into account.
4. The findings of this study might be a baseline for in-service teachers and administrators to utilize board games in the school's curriculum to empower both educators and learners.

6. References

Amushigamo, A. P. (2021). Teachers' and Students' Role in the Learner-Centered Classrooms: Experiences from Namibia. In *Research Anthology on Developing Critical Thinking Skills in Students*, 800-813.Retrieved

from https://www.igi-global.com/chapter/teachers-and-students- role-in-the- learner- centered-classrooms/269920.

Barbosa and Vale (2016) *"Math Trails: Meaningful Mathematics Outside the Classroom with Pre-Service Teacher"*. Retrieved from https://jetenonline.org/index.php/jeten/article/view/104/110

Barana, A., & Marchisio, M. (2020*). An interactive learning environment to empower engagement in Mathematics*. Retrieved fromhttps://iris.unito.it/retrieve/handle/2318/1761121/675743/45_14.pdf

Bragg, L. A. (2012). The effect of mathematical games on on-task behaviours in the primary classroom. *Mathematics education research journal*, 24(4), 385-401. Retrieved from: https://link.springer.com/article/10.1007/s13394-012-0045-4

Brannan, J. D., White, A., & Long, J. (2016). Learning styles: Impact on knowledge and confidence in nursing students in simulation and classroom. *International journal of nursing education scholarship,* 13(1), 63-73. Retrieved from https://www.degruyter.com/document/doi/10.1515/ijnes-2015-0052/html page-v2.pdf?

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed   methods research* (2nd ed.). Thousand Oaks, CA: Sage.Retrieved from https://doc1.bibliothek.li/acd/FLMF050277.pdf

DiCerbo, K. E. (2015). Assessment of task persistence. In Y. Rosen, S. Ferrara, &

M. Mosharraf (Eds.) *Handbook of Research on Computational Tools for Real- World Skill Development* , 780–806. Retrieved from https://www.igi- global.com/chapter/assessment-of-task-persistence/139711

Fabiyi, T.R.. (2017). Geometry Concepts in Mathematics Perceived Difficult To Learn   By Senior Secondary School Students in Ekiti State, *Nigeria. IOSR Journal of Research & Method in Education* (IOSRJRME). 07. 83-90.10.9790/7388- 0701018390. Retrieved from https://www.iosrjournals.org/iosr-jrme/papers/Vol-7%20Issue 1/Version- 1/K0701018390.pdf

Heinzen,Thomas. (2014). Game-Based Assessment: Two   Practical   Justifications. 10.13140/2.1.3251.7441.Retrievedfrom   https://www.researchgate.net/profile/Thomas-Heinzen-2/publication/271515597_GameBased_Assessment_Two_Practical_Justifi

cations/links/54ca63ad0cf2517b755 e0620/Game-Based-Assessment-Two-Practical- Justifications.pdf

Kirkland, D., & O'Riordan F. (2010) "Games as an Engaging Teaching and LearningTechnique: Learning or playing?" Retrieved from http://icep.ie/wp- content/uploads/2010/01/Kirkland_et_al.pdf

Lascoña, E. et. al (2019) Geonopoly as a Formative Assessment: Effects on Grade 7 Learners' Achievement and Attitude Towards Geometry

Lester, D. (2013). A review of the student engagement literature. Focus on colleges, universities & schools, 7(1).

Majdoub, M. (2022). Applying Gamification to Enhance the Universal Design for Learning Framework. *Handbook of Research on Transformative and Innovative Pedagogies in Education*, 233-256. Retrieved from: https://www.igiglobal.com/chapter/applying-gamification-to-enhance-the-universal- design-for-learning-framework/297600

McAndrew, E. M., Morris, W. L., & Fennell, F. (2017). Geometry-Related Children's Literature Improves the Geometry Achievement and Attitudes of Second-Grade Students. *School Science and Mathematics*, 117(1-2), 34-51. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/ssm.12202

Okechukwu, Abonyi & Maduagwuna, Nkechi & O Ugama, Julius. (2014). Effect of Mathematical Game on Students Achievement in Quadratic Expressions. International Journal of Scientific and Engineering Research. 5. 678 - 684. Retrieved from: https://www.researchgate.net/publication/263590460_Effect_of_Mathematical_Game_on_Students_Achievement_in_Quadratic_Expressions on October 19, 2018.

Türkoglu, B. (2019). A Mixed Method Research Study on the Effectiveness of Board Game Based Cognitive Training Programme. *International Journal of Progressive Education*, 15(5), 315-344. Retrieved from https://eric.ed.gov/?id=EJ1232511

Yilmazer, Z., & Keklikci, H. (2015). The effects of teaching geometry on theacademic achievement by using puppet methods. *Procedia-Social and Behavioral Sciences*, 191,   2355-2358.Retrieved   from https://www.sciencedirect.com/science/article/pii/S1877042815027238

Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The impact of gamification on learning and instruction: A systematic review of empirical evidence. *Educational Research Review*, 100326. Retrieved from https://doi.org/10.1016/j.edurev.2020.100326